Remarks

Applicants respectfully request reconsideration of the above-identified application in view of the present amendment and the following remarks.

Claims 1-20 were pending. By this paper, Applicants have amended claim 10 and added new claims 21 and 22. No new matter has been introduced by virtue of the present Amendment. After entry of this Amendment, claims 1-22 will be pending.

Claim 10 was rejected under 35 U.S.C. § 112, second paragraph. Applicants have amended claim 10 to obviate the rejection. Accordingly, Applicants respectfully request withdrawal of the 35 U.S.C. § 112, second paragraph rejection.

Claims 1-16 were rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 6,179,039 to Grinberg et al., hereinafter, "*Grinberg*" in view of U.S. Patent No. 5,731,030 to Friese et al., hereinafter "*Friese*". Applicants respectfully traverse this rejection.

Claim 1 recites method for controlling the manufacture of a spray-formed tool. The method comprises applying a metallic spray-forming material upon a mold substrate in the manufacture of a spray-formed tool, detecting temperatures during application of the spray-forming material for at least one position on an exposed surface of the spray-formed tool, performing a one dimensional simulation that is predictive of characteristics of the spray-formed tool based on the detected temperatures, and controlling subsequent application of the spray-forming material based on the predicted characteristics.

The present invention is patentable. The law is clear that a patent is to be granted unless the Examiner can establish that the invention would have been obvious at the time it was made. The Examiner fails this burden in at least two ways:

1. The suggestion to combine the references, required by the law, is missing; and

2. The combined references do not disclose, teach or suggest the claimed invention.

A. The Examiner Has Not Established The Requisite Motivation To Combine The References

The Examiner acknowledges that neither *Grinberg* nor *Friese*, alone, disclose, teach or suggest the present invention. The Examiner combines *Grinberg* with *Friese* stating that:

> *Grinberg et al.* fails to teach the use of detecting temperatures during application of the spray-forming material. However, *Friese et al.* (col. 3, lines 19+) teach the use of a radiation pyrometer 4 to detect temperature during application of the spray-forming material with accurate thickness deposited at a specific location of a substrate or at an exposed surface formed from a plurality of spray passes (col. 3, lines 45+) and at a specific time for the purpose of controlling spray quality. It would have been obvious to one having ordinary skill in the art to provide *Grinberg et al.* detecting temperature during application of the spray-forming material as taught by *Friese et al.* in order to effectively enhance the quality of manufacturing a spray-formed tool.
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> (January 7, 2004 Office Action, Page 3).

Applicants disagree with these assertions. There is no motivation in the prior art to combine *Grinberg* with *Friese* to teach the present invention. Specifically, the Examiner's assertion that "it would have been obvious...to provide *Grinberg et al.* detecting temperature during application of the spray forming material as taught by *Friese et al.* in order to effectively enhance the quality of manufacturing a spray-formed tool" is nothing more than an unsupported conclusion offered to piece together a tenuous rejection. As set forth in more

detail below, the Examiner has not provided any of the requisite evidence of a suggestion to combine the references.

The law requires that there be some teaching, suggestion or motivation to combine the two references. Otherwise, the concern is that hindsight is impermissibly being used to evaluate the invention. To prevent the use of hindsight based on the invention, the law specifically requires the Examiner show a motivation to combine the references. As set forth in several CAFC cases, this requirement for showing the motivation to combine the references is rigorous.

The Examiner has failed to show the requisite motivation to combine the references because none exist. *Grinberg* is directed to a method of reducing distortion in spray formed tools. Specifically, *Grinberg* is directed to improving upon the prior art method of relying on trial spray runs, based upon trial and error, to determine the desired spray parameters for spraying spray forming tools. The manner in which *Grinberg* overcomes this is to build a thermal model of a desired tool from a solid model of the geometry of the ceramic spray pattern. The model is built as a computer program with the use of computational fluid dynamics to model the heat transfer properties of the ceramic pattern and the thermal spray pattern. The thermal model is then run on a conventional computer and the results are analyzed. The method determines if there are any temperature deviations in the temperature distribution. If temperature deviations exist, the spray parameters are adjusted to insure uniform temperature distribution while the spray formed rapid tool is being formed. After resolving any temperature deviations in the temperature distribution, *Grinberg* thermally sprays metallic material against the ceramic pattern to form the desired tool according to the model.

The focus on *Grinberg* is to produce a method that reduces distortion in the spray formed rapid tool by maintaining a uniform temperature distribution across the ceramic pattern and thermal spray layers during spraying. According to *Grinberg*, this will insure that shrinkage will be uniform regardless of phase transformation. (Column 4, lines 62-66). Thus, *Grinberg* is only concerned with maintaining uniform temperature distribution and is not

concerned with the phase transformation that occurs during the spraying. *Grinberg* believes that employing his method, he can insure that the spray formed rapid tools generated according to his method have geometric accuracy and little or no distortion without having to resort to numerous trial and error trial spray runs to determine the spraying parameters. Since *Grinberg's* focus is to determine the spraying parameters in advance of spraying, Applicants fail to see how *Grinberg* would be motivated to look to another teaching for disclosure on monitoring the spraying process to obtain information such as temperature, to input into a one dimensional simulation predicative of characteristics of the spray forming tool for controlling subsequent application of the spray forming material based upon the predicted characteristics. As such, Applicants fail to see how *Grinberg* would be motivated to look to *Friese* to teach the present invention. *Grinberg* is not concerned with controlling subsequent application of the spray form process based upon data collected during the spraying process but is only concerned with attempting to control the spray forming process based upon data collected and analyzed before the spraying begins.

Furthermore, *Friese* is not directed to monitoring the spray forming process to insure that the sprayed material has little or no distortion. Instead, *Friese* uses a pyrometer to measure the temperature of the sprayed surface to determine the thickness of the sprayed part. *Friese* has no concern for the quality of the coating on the part or for the stress that are potentially created during the process. *Friese* is directed to a plasma spraying method for coating parts. *Friese* deals with the problem in the prior art of coating parts with accuracy and in part thickness. The prior art in *Friese* was to weigh the parts before and after the coating and roughly determine average layer thickness. This process was costly and lead to the rejection of many sprayed parts because of inaccurate sizing. To overcome this problem, *Friese* uses a pyrometer to detect the temperature of the spray formed part as a correlation to mass transfer to control the desired thickness of the spray formed part. Applicants fail to see how there is any suggestion in either reference to combine them with each other to teach the present invention. Accordingly, in view of the lack of evidence to suggest the combination of the references, Applicants respectfully submit that the combination of the references is improper and that the rejection should be withdrawn.

B. The Improper Combination of *Grinberg* and *Friese* Does not Disclose, Teach or Suggest the Claimed Invention

Assuming arguendo that *Grinberg* and *Friese* were properly combinable, as the Examiner posits, the resulting combination does not disclose, teach or suggest the present invention. The present invention recites performing a one dimensional simulation that is predicative of characteristics of the spray-formed tool based upon detected temperatures and controlling subsequent application of the spray forming material based upon the predicted characteristics. Even combining *Grinberg* with *Friese*, these limitations are disclosed, taught or suggested by the combination. There is no one dimensional simulation performed in either *Grinberg* or *Friese*. The one dimensional simulation of the present invention comprises performing the simulation for a column that is a vertical section of the spray formed tool from the exposed surface of the spray formed tool down to the interface of the mold substrate. Such a simulation is not disclosed, taught or suggested by the prior art.

Accordingly, since the combination of *Grinberg* and *Friese* is improper as a result of the Examiner's failure to provide the requisite motivation in the prior art to combine the references, and (2) when combined, the improper combination fails to disclose, teach or suggest the claimed invention, claim 1 is allowable.

Claims 2-22 all depend either directly or indirectly from independent claim 1 and are therefore patentable for at least the same reasons as independent claim 1. Moreover, these claims add further limitations which better define the invention and render them separately allowable.

For instance, claim 3 recites that performing the one dimensional simulation further comprises performing the one dimensional simulation for a column that is a vertical section of the spray-formed tool that is at least one position on the exposed surface of the spray-formed tool down to an interface with the mold substrate. There is no such disclosure, teaching or suggestion of this limitation in the prior art.

Claim 6 recites that performing the one dimensional simulation further comprises performing the one dimensional simulation using the one dimensional modeling technique based on an assumption that heat flows only up and down along the column that is the vertical section of the spray-formed tool and is radiated off straight upward or conducted straight downward into the substrate mold. There is no disclosure, teaching or suggestion of these limitations in the prior art.

Claim 7 recites that performing the one dimensional simulation further comprises using the one dimensional modeling technique to predict phase transformations and residual stresses occurring within the spray-formed tool. There is no disclosure, teaching or suggestions of these limitations in the prior art. Specifically, *Grinberg* states that it is not concerned with controlling phase transformation. (Col. 4, lines 62-66). Instead, *Grinberg* is only concerned with maintaining uniform temperature distribution across the spraying surface. It is unclear how the limitations of claim 7 could be believed to be found in the prior art.

Claim 8 recites that performing the one dimensional simulation further comprises using the one dimensional modeling technique to solve a heat equation at every instant time during the application of the spray forming material. There is no disclosure, teaching or suggestion of these limitations in the prior art.

Claim 21 recites that controlling the subsequent application of the spray-forming material comprises causing predetermined phase transformations in the metallic spray-forming material comprising at least two commingled metallic phases. There is no teaching, disclosure or suggestion of this limitation in the prior art. Again, *Grinberg* is not concerned with controlling phase transformation.

Claim 22 recites that the at least two commingled metallic phases consist of a predetermined portion of an austenite phase in at least one of a predetermined portion of a bainite phase in a martensite phase. This commingled phase creates "plastic" zones that

alleviate stress and help to prevent distortion of the part. There is no disclosure, teaching or suggestion of this limitation in the prior art.

Notably, claims 17-20 were rejected under 35 U.S.C. § 103(a) as being unpatenable over *Grinberg* in view of *Friese* and further in view of Harlow, Jr. et al., hereinafter "*Harlow*". The rejection of claims 17-20 are based upon the improper combination of *Grinberg* and *Friese*. There is nothing in *Harlow* that cures the defects with the improper combination of *Grinberg* and *Friese*. *Hawlow* has only offered to teach the use of robotic control. As such, Applicants respectfully submit that the rejection of claims 17-20 over *Grinberg* in view of *Friese* and further in view of *Harlow* is improper for substantially the same reasons as the rejection of claim 1 is improper. Accordingly, Applicants respectfully request the removal of the rejection of claims 17-20.

Applicants submit that the claims are in a condition for allowance and respectfully request a notice to that effect. If the Examiner believes that a telephone conference will advance the prosecution of this application, such a conference is invited at the convenience of the Examiner.

The Commissioner is hereby authorized to charge the $36.00 additional claim fee and any fee deficiency associated with the filing of this Paper to the Deposit Account of Applicants' assignee, Ford Global Technologies LLC, Deposit Account No. 06-1510 -- a duplicate of the Amendment Transmittal paper is enclosed for that purpose.

Respectfully submitted,

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